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09/834,308	04/11/2001	Saleem H. Zaidi	S-041,101	3035

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EXAMINER	
MUTSCHLER, BRIAN L	
ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 11/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/834,308	Applicant(s) ZAIDI, SALEEM H.
	Examiner Brian L. Mutschler	Art Unit 1753

-- The MAILING DATE of this communication appears on the cover sh et with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 13 June 2003 .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-24 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-24 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Comments

1. The rejection of claims 15-24 under 35 U.S.C. § 112, second paragraph, has been overcome by Applicants amendment to the claims.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 5, 6 and 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admissions of prior art in view of Czubatyj et al. (U.S. Pat. No. 4,419,533).

In the present disclosure (see page 5, lines 6-29), Applicant discloses:

> Subwavelength periodic grating structures can be most conveniently fabricated using laser interference techniques (See, e.g., A. Malag, Opt. Commun. 32, 54 (1980), and Saleem H. Zaidi and S. R. J. Brueck, Appl. Opt. 27 (1988) describe typical fabrication techniques for these types of one- and two-dimensional structures. Interference between two coherent laser beams produces a simple periodic pattern at $d=\lambda/2\sin\theta$, where λ is the exposure wavelength, and 2λ is the angle between the two intersecting laser beams. For $\lambda=0.355$ µm, $\theta=60^\circ$, periods as low as ~0.2-µm can easily be fabricated. **Typically, grating structures are first formed in photoresist followed by pattern transfer to Si using an appropriate combination of wet and dry etching techniques. Silicon reactive ion etching (RIE) techniques have been very well characterized** (See e.g., P. M.

> Kopalidis and J. Jorne J. Electrochem. Soc., Vol. 139 (1992) which describes Si etching in SF_6/O_2 plasma chemistries). **Wet-chemical etching of Si is also well understood** (See e.g., K. E. Bean, IEEE Trans. Elect. Dev., ED-25, 1185 (1978)). Grating solar cells, or photodetectors can be made by adding a laser interference lithography step to the typical device fabrication sequence (See e.g., A. H. Fahrenbruch and R. H. Bube in *Fundamentals of Solar Cells*, Academic Press (1983)). FIG. 2 is a schematic representation of a typical top- and bottom-contact grating solar cell. **Front (10) and back (50) surface contacts are formed using appropriate metal stacks taught in *Fundamentals of Solar Cells, supra*. The appropriate one-dimensional (1D) or two-dimensional (2D) grating (30) is etched on the front Si surface. Junction (20) is formed on the front surface following grating fabrication, the doping type being opposite to the wafer doping (40). For example, if the wafer is p-type, the junction will be n-type, and vice versa.** (Emphasis added by Examiner.)

Regarding claim 2, the device is a solar cell (p. 7, lines 22-23).

Regarding claim 3, the solar cell comprises silicon (p. 7, lines 26-27).

Regarding claims 6 and 8, the method of forming the gratings may comprise reactive ion etching (RIE) or wet chemical etching (p. 7, lines 13-19).

Regarding claim 9, the grating comprises rectangular projections (see Figure 2).

The method disclosed by the present application differs from the instant invention because the method does not disclose the following:

a. The grating forms higher grating orders and a greater amount of incident light entering the device propagates more closely to the surface upon which the light is incident than is achieved by refraction, as recited in claim 1.

b. The device comprises silicon having a thickness of <100 μm, as recited in claim 5.

c. The grating comprises triangular projections, as recited in claim 10.

d. The grating comprises a blazed grating, as recited in claim 11.

e. The grating is chosen to have optimum performance within the solar spectrum, as recited in claim 12.

f. The method comprises the step of anti-reflection coating the surface of the grating upon which light is incident, as recited in claim 13.

Regarding claim 1, Czubatyj et al. disclose a method of forming a grating solar cell comprising a transmission diffraction grating **178** on the light incident side of the solar cell **170**, wherein the transmission diffraction grating **178** is "arranged to direct all of the incident light through the intrinsic region **180** at an angle" (col. 15, lines 38-51). The grating **178** is shown to be a sinusoidal diffraction grating, but it can also comprise any of the other disclosed gratings, such as the blazed grating, which is "preferred because the zero (0) order reflections [transmissions in a transmissive grating], those normal to the grating, are minimized" (col. 14, lines 47-53; col. 15, lines 49-51). Czubatyj et al. also disclose, "designing a diffraction grating for higher order diffraction will provide greater angle to achieve internal reflection before this interface" (col. 15, lines 34-37; see also col. 6, lines 9-45).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the grating of the prior art method to use a diffraction grating that directs all the light at an angle, such as a blazed grating

minimizing zero order diffraction, as taught by Czubatyj et al. because directing the light at an angle allows the longer wavelength light to be absorbed by the solar cell.

Regarding claim 5, Czubatyj et al. disclose using silicon to form the solar cell, wherein the solar cell comprises an n+ region having a thickness between 50 and 500 angstroms (0.005-0.050 μm), an intrinsic region having a thickness of about 4500 angstroms (0.45 μm) and a p+ region "as thin as possible" and having a thickness between 50 to 500 angstroms (0.005-0.050 μm) (col. 12, lines 22-55).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of the prior art to be made of silicon and have a thickness of less than 100 μm as taught by Czubatyj et al. because silicon is a inexpensive and efficient material for converting sunlight into electrical energy.

Regarding claims 10 and 11, the blazed grating of Czubatyj et al. has triangular projections and minimizes zero order diffraction (col. 14, lines 47-53).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the grating of the prior art method to use a blazed grating as taught by Czubatyj et al. because a blazed grating minimizes zero order diffraction.

Regarding claim 12, Czubatyj et al. discloses that the grating **178** "can be optimized for the longer wavelengths" so that the longer wavelengths can be absorbed by the solar cell (col. 15, lines 38-51).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have optimized the grating of the prior art method as taught by Czubatyj et al. because optimizing the grating allows the longer wavelength light to be absorbed by the solar cell.

Regarding claim 13, Czubatyj et al. disclose forming an anti-reflective coating **186** on the grating **178** (col. 15, lines 52-56).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of the prior art to form an anti-reflection coating on the grating as taught by Czubatyj et al. because the anti-reflection coating allows more light to enter the solar cell, increasing the conversion efficiency of the solar cell.

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admissions of prior art in view of Czubatyj et al. (U.S. Pat. No. 4,419,533), as applied above to claims 1-3, 5, 6 and 8-13, and further in view of Mizuno et al. ("High efficiency solar cells enhanced with diffraction grating", Technical Digest of the International PVSEC-11).

The method of the disclosed prior art and Czubatyj et al. describe a method having the limitations recited in claims 1-3, 5, 6 and 8-13 of the instant invention, as explained above in section 6.

The method described by the prior art and Czubatyj et al. differs from the instant invention because they do not disclose the formation of a grating on both sides of the device, as recited in claim 4. Czubatyj et al. discloses gratings on both front and rear surfaces of the solar cell, but does not disclose an embodiment comprising two gratings at the same time.

Mizuno et al. teach, "The diffraction grating can be adhered onto the front and back surface of thin film single crystal silicon" and that "light can be confined efficiently in the solar cells" (abstract).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by the prior art and Czubatyj et al. to use a grating on the front and back surfaces to efficiently confine light in the solar cells.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admissions of prior art in view of Czubatyj et al. (U.S. Pat. No. 4,419,533), as applied above to claims 1-3, 5, 6 and 8-13, and further in view of Pang et al. ("Damage induced in Si by ion milling or reactive ion etching", Journal of Applied Physics) and Sakaguchi et al. (U.S. Pat. No. 5,492,859).

The method of the disclosed prior art and Czubatyj et al. describe a method having the limitations recited in claims 1-3, 5, 6 and 8-13 of the instant invention, as explained above in section 6.

The method described by the prior art and Czubatyj et al. differs from the instant invention because they do not disclose the step of selective KOH etching to remove reactive ion etching induced surface damage, as recited in claim 7.

Pang et al. identify the damage done to silicon surfaces by reactive ion etching and teach that the damage can be reduced to pre-etched states by wet chemical etching (abstract).

Sakaguchi et al. disclose that KOH can be used for selective etching of silicon (col. 15, line 9).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by the prior art and Czubatyj et al. to use a wet chemical selective etching step because Pang et al. teach that wet chemical etching can repair damage caused by reactive ion etching. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used KOH for the selective etching because Sakaguchi et al. teach that KOH is a known compound for selectively etching silicon, and the selection of known compounds based on their suitability for the intended use is considered to be obvious to one skilled in the art (see MPEP 2144.07).

6. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admissions of prior art in view of Czubatyj et al. (U.S. Pat. No. 4,419,533), as applied above to claims 1-3, 5, 6 and 8-13, and further in view of Ruby et al. (U.S. Pat. No. 5,792,280).

The method of the disclosed prior art and Czubatyj et al. describe a method having the limitations recited in claims 1-3, 5, 6 and 8-13 of the instant invention, as explained above in section 6.

The method described by the prior art and Czubatyj et al. differs from the instant invention because they do not disclose the use of ion-implantation to form the junction, as recited in claim 14. The prior art method in the instant disclosure states, "Junction (20) is formed on the front surface following grating fabrication" (p. 7, lines 26-28).

In US '280, Ruby et al. disclose a method for forming a junction in a solar cell using suitable deposition means, such as ion implantation (col. 4, lines 9-24).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have formed the junction in the method described by the prior art and Czubatyj et al. by ion implantation as taught by Ruby et al. because ion implantation is a suitable deposition means.

7. Claims 15-17 and 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admissions of prior art in view of Czubatyj et al. (U.S. Pat. No. 4,419,533), Pang et al. ("Damage induced in Si by ion milling or reactive ion etching", Journal of Applied Physics), and Ruby et al. (U.S. Pat. No. 5,792,280).

In the present disclosure (see page 5, lines 6-29), Applicant discloses:

> Subwavelength periodic grating structures can be most conveniently fabricated using laser interference techniques (See, e.g., A. Malag, Opt. Commun. 32, 54 (1980), and Saleem H. Zaidi and S. R. J. Brueck, Appl. Opt. 27 (1988) describe typical fabrication techniques for these types of one- and two-dimensional structures. Interference between two coherent laser beams produces a simple periodic pattern at $d=\lambda/2\sin\theta$, where λ is the exposure wavelength, and 2λ is the angle between the two intersecting laser beams. For $\lambda=0.355$ µm, $\theta=60^\circ$, periods as low as ~0.2-µm can easily be fabricated. **Typically, grating structures are first formed in photoresist followed by pattern transfer to Si using an appropriate combination of wet and dry etching techniques. Silicon reactive ion etching (RIE) techniques have been very well characterized** (See e.g., P. M. Kopalidis and J. Jorne J. Electrochem. Soc., Vol. 139 (1992) which describes Si etching in SF_6/O_2 plasma chemistries). **Wet-chemical etching of Si is also well understood** (See e.g., K. E. Bean, IEEE Trans. Elect. Dev., ED-25, 1185 (1978)). Grating solar cells, or photodetectors can be made by adding a laser interference lithography step to the typical device fabrication sequence (See e.g., A. H. Fahrenbruch and R. H. Bube in *Fundamentals of Solar Cells*, Academic Press (1983)). FIG. 2 is a schematic representation of a typical top- and bottom-contact grating solar cell. **Front (10) and back (50) surface contacts are formed using appropriate metal stacks taught in *Fundamentals of Solar Cells, supra*. The appropriate one-dimensional (1D) or two-dimensional (2D) grating (30) is etched on the front Si surface. Junction (20) is formed on the front surface following grating fabrication, the doping type being opposite to the wafer doping (40). For example, if the wafer is p-type, the junction will be n-type, and vice versa.** (Emphasis added by Examiner.)

Regarding claims 16, 19, 21 and 24, the method of forming the gratings may comprise reactive ion etching (RIE) or wet chemical etching (p. 7, lines 13-19).

The method disclosed by the present application differs from the instant invention because the method does not disclose the following:

a. The grating forms higher grating orders and a greater amount of incident light entering the device propagates more closely to the surface upon which the light is incident than is achieved by refraction, as recited in claims 15 and 20.

b. Removing surface contamination, as recited in claim 15.

c. Forming an n-type junction using gas source doping, as recited in claim 15.

d. Removing reactive ion etching-induced surface damage using wet chemical etching, as recited in claim 17.

e. Cleaning the surface to remove surface contamination, as recited in claim 20.

f. Forming an n-type junction by ion implantation, as recited in claim 20.

g. Annealing the solar cell, as recited in claim 20.

h. Using $^{31}P^{+}$ for the ion implantation, as recited in claim 22.

i. Annealing the solar cell by heating the solar cell in an oxygen atmosphere, as recited in claim 23.

Regarding claims 15 and 20, Czubatyj et al. disclose a method of forming a grating solar cell comprising a transmission diffraction grating **178** on the light incident side of the solar cell **170**, wherein the transmission diffraction grating **178** is "arranged to direct all of the incident light through the intrinsic region **180** at an angle" (col. 15,

lines 38-51). The grating **178** is shown to be a sinusoidal diffraction grating, but it can also comprise any of the other disclosed gratings, such as the blazed grating, which is "preferred because the zero (0) order reflections [transmissions in a transmissive grating], those normal to the grating, are minimized" (col. 14; lines 47-53; col. 15, lines 49-51). Czubatyj et al. also disclose, "designing a diffraction grating for higher order diffraction will provide greater angle to achieve internal reflection before this interface" (col. 15, lines 34-37; see also col. 6, lines 9-45).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the grating of the prior art method to use a diffraction grating that directs all the light at an angle, such as a blazed grating minimizing zero order diffraction, as taught by Czubatyj et al. because directing the light at an angle allows the longer wavelength light to be absorbed by the solar cell.

Regarding claims 15, 17 and 20, Pang et al. identify the damage done to silicon surfaces by reactive ion etching and teach that the damage can be reduced to pre-etched states by wet chemical etching (abstract).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by the prior art to use a wet chemical selective etching step because Pang et al. teach that wet chemical etching can repair damage caused by reactive ion etching.

Regarding claims 15, 20 and 22, the prior art method in the instant disclosure states, "Junction (20) is formed on the front surface following grating fabrication" (p. 7, lines 26-28). In US '280, Ruby et al. disclose a method for forming an n-type junction in a solar cell using suitable deposition means, such as ion implantation and a gaseous dopant material including phosphorous as the dopant material (^{31}P is the most abundant isotope of phosphorous) (col. 4, lines 9-24).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have formed the junction in the method described by the prior art by ion implantation and gaseous dopant methods as taught by Ruby et al. because ion implantation is a suitable deposition means.

Regarding claims 20 and 23, Ruby et al. also teach a method of annealing the solar cell by heating the solar cell in an oxygen atmosphere (col. 6, lines 59-64).

It also would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of the prior art to anneal the solar cell in an oxygen atmosphere as taught by Ruby et al. because annealing the solar cell in an oxygen atmosphere can form an anti-reflecting and passivating oxide layer on the solar cell.

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admissions of prior art in view of Czubatyj et al. (U.S. Pat. No. 4,419,533), Pang et al. ("Damage induced in Si by ion milling or reactive ion etching", Journal of

Applied Physics), and Ruby et al. (U.S. Pat. No. 5,792,280), as applied above to claims 15-17 and 19-24, and further in view of Sakaguchi et al. (U.S. Pat. No. 5,492,859).

The disclosed prior art, Czubatyj et al., Pang et al. and Ruby et al. described a method having the limitations recited in claims 15-17 and 19-24 of the instant invention, as explained above in section 10.

The method described by the disclosed prior art, Czubatyj et al., Pang et al. and Ruby et al. differs from the instant invention because they do not disclose the exposing the surface to KOH and nitric acid solutions to perform the step of wet chemical etching, as recited in claim 18.

Sakaguchi et al. teach the use of KOH and nitric acid solutions to perform selective etchings (col. 15, line 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by the disclosed prior art, Czubatyj et al., Pang et al. and Ruby et al. to use KOH and nitric acid solutions to clean the surface damage of the solar cell because KOH and nitric acid solutions are known compounds for selectively etching silicon, and the selection of known compounds based on their suitability for the intended use is considered to be obvious to one skilled in the art (see MPEP 2144.07).

Response to Arguments

9. Applicant's arguments filed September 29, 2003, have been fully considered but they are not persuasive.

10. Applicant has argued that the teachings of Czubatyj et al. differ from the instant invention because Czubatyj et al. only use the gratings to enhance the absorption at the band edge (see the last paragraph on page 9 of Applicant's response). Applicant also argues that Czubatyj et al. further differ because the instant invention does not require a reflective surface opposite the front surface grating (see first paragraph on page 10 of Applicant's response). Applicant further provides data showing that wavelengths below 0.66 μm, the diffraction orders propagate at angles less than the critical angle (see page 11 of Applicant's response).

11. Applicant's response has been carefully considered, but the arguments presented are not persuasive for the following reasons. In regard to Applicant's argument based on Czubatyj et al.'s use of gratings only to enhance the absorption of the band edge, it is noted that the instant claims do not include limitations relating to the wavelengths whose absorption is increased. Since Czubatyj et al. teach at least the increased absorption of the longer wavelengths and the total absorption of substantially all of the shorter wavelengths on the first pass, the reference is deemed to teach a method for increasing absorption of light radiation. It is further noted that Czubatyj et al. teach the desirability of "substantially total absorption while assuring more complete collection of the electron-hole pairs" (see US '533 at col. 6, lines 3-8).

12. In regard to Applicant's argument that the instant invention does not require a reflective surface, the instant claims use open language that does not prohibit the use of reflective surfaces opposite the light-incident surface. Since Czubatyj et al. teach the use of a transparent radiation director (radiation director = diffraction grating) on the top

layer of the solar cell device, thus satisfying all of the structural limitations recited in the instant claims. The use of a reflective surface is not excluded in the instant claims, and the teachings of Czubatyj et al. are therefore not in conflict with the instant claims.

13. Regarding Applicant's presented data and suggestions that the diffraction orders propagate at an angle less than the critical angle, the teachings of Czubatyj et al. contradict those suggestions. Czubatyj et al. state, "For normal radiation incidence, the radiation directing means directs the radiation through the active region or regions at angles at least greater than the angle (the critical angle) whose sine is the index of refraction of air divided by the index of refraction of the material which forms the active region or regions" (see US '533 at col. 5, line 65 to col. 6, lines 3). The data presented in Applicant's response appears to contradict the express teaching of Czubatyj et al.

14. The teaching of Czubatyj et al. leads to the same result as Applicant's claimed method. By directing incident radiation through the active region at angles at least greater than the critical angle, the absorption of light close to the surface would be enhanced in comparison to undirected incident radiation.

15. The data presented by Applicant raises the question of how the device of the instant invention is distinct from the devices of the prior art. As presented the broad nature of the claims (i.e., increasing absorption of light radiation by forming a grating on the surface of the device) in combination with relative terminology (e.g., increasing light absorption *close to the surface* upon which light is incident) opens the claims up to a broad interpretation. A key feature of the instant invention appears to be the limitation "increasing light absorption by said photo responsive device close to the surface upon

which light is incident" (see claim 1, lines 7-9). How is the instant invention different from the teachings of the prior art? Czubatyj et al. teaches that the light radiation should be directed t angles at least greater than the critical angle, which would cause more light to be absorbed close to the surface due to the path which proceeds nearer to the surface than undirected light. In light of the teachings of Czubatyj et al. in combination with the other prior art of record, the instant claims do not appear to be distinguished from the prior art.

Conclusion

16. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703)

305-0180. The examiner can normally be reached on Monday-Friday from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

blm
November 6, 2003

NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700